

Efficiency analysis of combined biomass and solar energy in Lithuania

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Abstract In this paper were performed analyses of the renewable energy impact on reduction of the greenhouse gas (GHG) emissions. The pilot integrated biomass and solar water heating system at public institutions of Lithuania were analyzed. Purpose of this analysis was to evaluate systems' efficiency of performance. It has been executed for measurements of produced energy, consumed water, and burned biofuel in summer and winter time. Analysis showed that heat load for domestic hot water is too low for biomass boiler for summer season. That problem could be improved with optimizing solar heating system. Modernization of this system could significantly reduce energy costs and emissions of carbon dioxide and demonstrate an integrated solution with bio and solar energies utilization in this system. Investigation shows that Lithuania can reduce GHG emission to 8 % in the period 2008–2012 by increasing use of biomass, solar, and others renewables and achieve the requirement of the Kyoto protocol.

Keywords Biomass · Wood chips · Solar energy · Solar irradiation · Solar collectors

Introduction

European Union and Lithuania have laws and other juridical documents which are declaring the promotion of wider renewable sources usage: (Directive 2009/28/ES; National energy strategy 2007; National Renewable Energy action plan 2010). It shows that Lithuanian energy politics are paying more attention for biomass, solar energy, and other renewable sources application development.

Recently in Lithuania growth of logging waste and wood processing industries technological waste (sawdust and chips) consumption are notable. Total wood and wood waste as fuel for the total consumption of the country in the year 2010 amounted to 934 ktOE. There is a constant increase in the installed capacity of biomass boilers in Lithuania. Wood fuel consumption represents over 80 % of RES in state's consumption volumes (Department of statistics Lithuania 2011; Katinas and Markevicius 2006).

Lack of wood in future in Lithuania may limit wood fuel consumption for heat and electricity generation (Vrubliauskas 2002), so accordingly a detailed evaluation of Lithuanian forests characteristics must be performed. All Lithuania's forests have accumulated ~1.7–2.2 million m³ of potential forest cutting residues and volumes will depend on felling volumes (Aleinikovas and Škema 2008). It is projected that these volumes will increase: 6.3 million m³/a during years 2001–2010 and 7.5 million m³/a during 2011–2020, thus the volumes of cutting residues will also grow; however, these volumes can also reduce because of changing growing conditions and technological processes. The use of forest cutting residues for wood fuel in some locations is restricted by the fact that it is impossible to remove waste, and in some other more damp locations residues are used for enforcement of haul. The paper by Mizaraite et al. (2007) examines the possibilities of increasing the use of wood from private forests

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